

## Evolutionary Theory

**Evolution** - change over time  
- process by which modern organisms have descended from ancient organisms.

Charles Darwin is credited with proposing the hypothesis which eventually became the theory of evolution.

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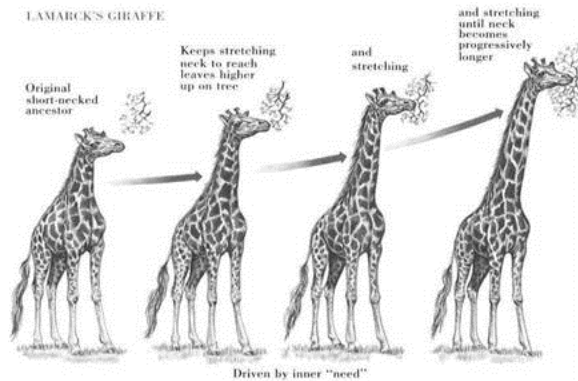
## History of Evolutionary Theory

1785 - James Hutton (father of modern Geology) estimated that Earth was millions of years old (not thousands)  
- Hutton proposed that the Earth was shaped by geological forces that had occurred over long periods of time.

1798 - Thomas Malthus wrote a book, *Essay on the Principle of Population*, in which he noted that human babies were being born in England at a faster rate death was occurring, leading Malthus to believe that eventually space and food availability could become an issue to human survival.  
- Darwin from reading Malthus's work realized that similar conditions could effect plants and animals.

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1809 - Jean-Baptiste Lamarck proposed that by *selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime. These traits could then be passed on to their offspring, and overtime led to change in a species.* (Problem - behavior does not affect inheritability)



### Lamarck's 3 Principles:

#### 1) Tendency Towards Perfection

- continual change to increase survival in an environment

#### 2) Use and Disuse

- bodies or organs could be altered based on how often the part was used

#### 3) Inheritance of Acquired Traits

- if an organism altered it's body in it's lifetime it would pass that alteration on to its offspring

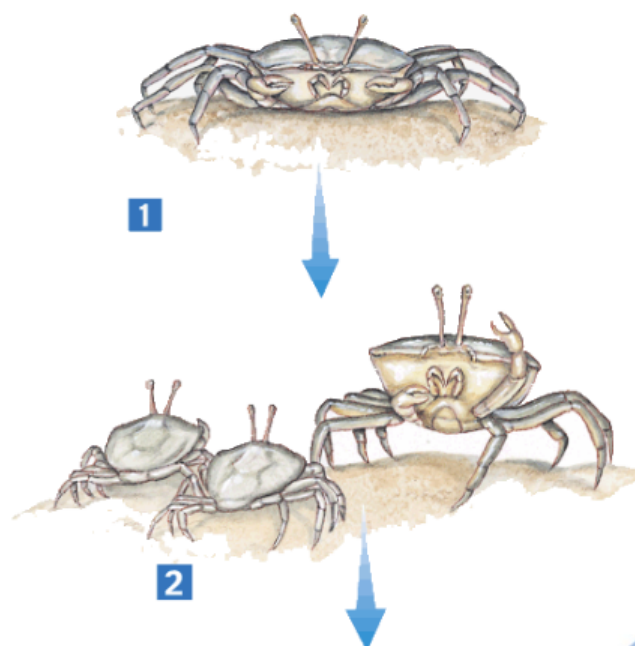
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15-2 Ideas That Shaped  
Darwin's Thinking

➡ Lamarck's Evolution Hypotheses

A male fiddler crab uses its front claw to ward off predators and to attract mates.

### Lamarck's Hypothesis

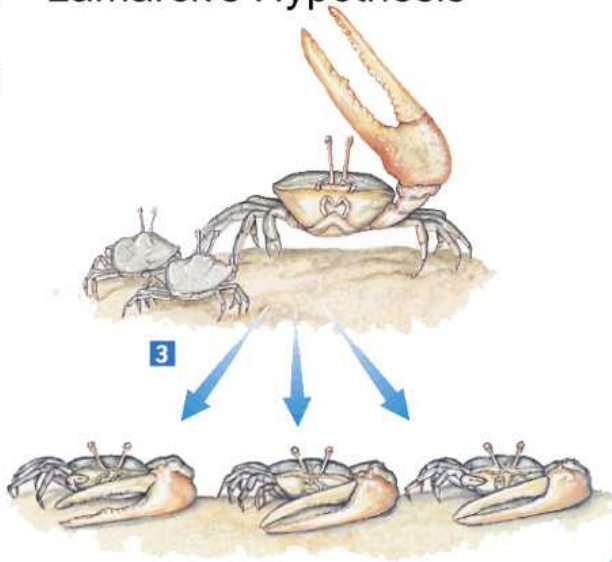


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15-2 Ideas That Shaped Darwin's Thinking → Lamarck's Evolution Hypotheses

Because the front claw is used repeatedly, it becomes larger.  
This characteristic (large claw) is passed onto its offspring.

### Lamarck's Hypothesis



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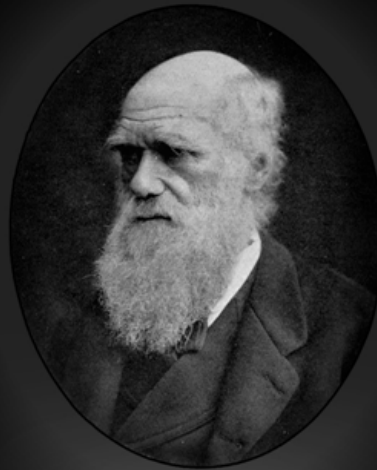
1812 - Georges Cuvier stated that "Fossil man does not exist!" He believed species were static and unchanging.

1833 - Charles Lyell wrote the *Principles of Geology*, a book which explained the fact that process that occur now (ex. volcanic eruptions) play a role in shaping Earth's geological features.

- Influenced Darwin by making him question whether life could change with time like the Earth. Lyell's book also caused Darwin to realize that change takes time.

1858 - Alfred Wallace wrote to Darwin speculating on the idea of evolution by natural selection.

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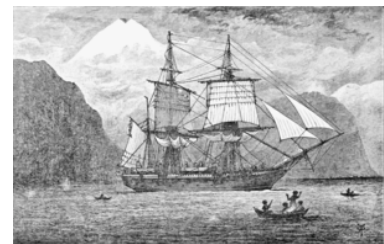
Charles Darwin

1809 - 1882

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## Darwin's Voyage on the H.M.S. Beagle (1831 - 1836)



Wherever the ship anchored Darwin collected samples of plants and animals to analyze. Darwin slowly came to the realization that an enormous number of species inhabited the Earth.

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## Darwin's Observations

**1. Patterns of Diversity** - intrigued by the fact that there were so many different species and that they were all equally suited for their environments.

**2. Living Organisms and Fossils** - Darwin in his travels collected a number of fossils and noted how many resembled species in existence while others did not.

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## Darwin and the Galapagos Islands

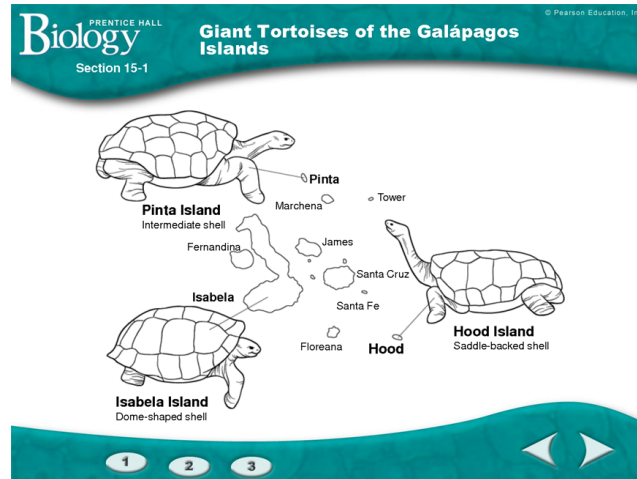


The Galapagos Islands are located 1000 km west of South America. Even though they are close together the islands have very different climates. While studying these islands Darwin paid particular attention to the land tortoises, marine iguanas, and little black birds (finches).

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## Darwin's Observations

The shape of the tortoise's shell was different from island to island and could be used to identify the island the tortoise inhabited.



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## The Journey Home

Darwin observed that the characteristics of many animals and plants varied between the islands.

Back in England Darwin began to wonder if these species which had a few similar traits (but also some different ones) were from a common ancestor.

Darwin compiled his ideas in a manuscript, but shelved it for years.

- Why would a scientist do such a thing?

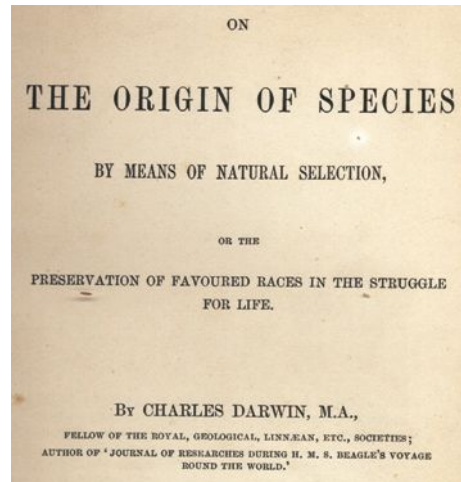
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## The Origin of Species

In 1859 Darwin published *On the Origin of Species* (18 months after receiving encourage from Wallace).

In his book he proposed a mechanism for evolution that he called **natural selection**.



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## Summarizing Natural Selection

### 1. Variation

- Individual organisms differ, and some of this variation is heritable.

### 2. Over Production

- Organisms produce more offspring than can survive, and many that do survive don't reproduce.

### 3. Struggle for Existence

- Because more organisms are produced than can survive, they compete for limited resources.

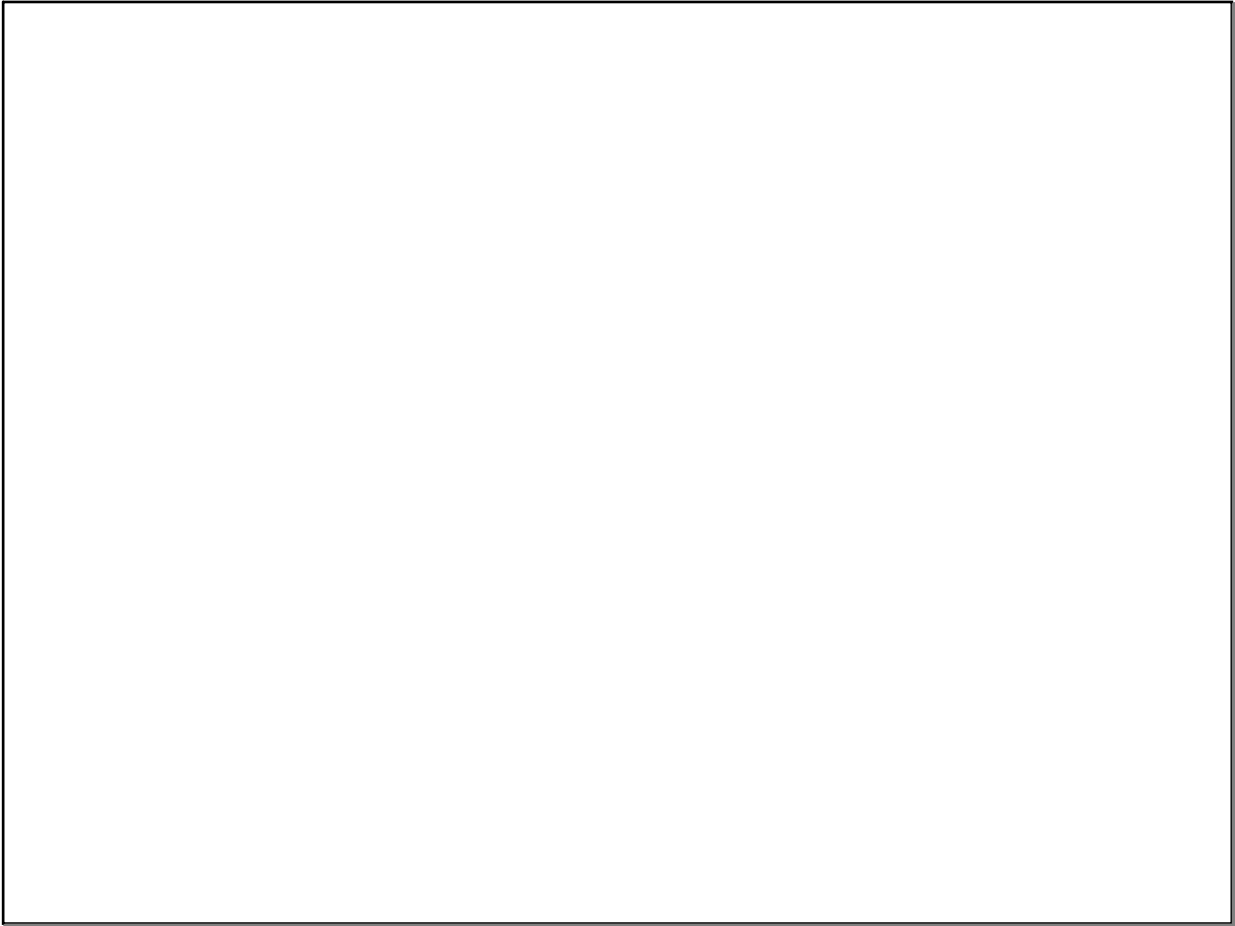
### 4. Survival of the Fittest

- Individuals best suited to their environments survive and reproduce passing their heritable traits to their offspring.

### 5. Origin of Species

- Species alive today are descended with modification from ancestral species (process known as gradualism)

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